TSR PRO and TSR PRO-HB
User's Manual

May 2011

13000-60160-MAN (Rev. 0)

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DTS Support

TSR PRO and TSR PRO-HB shock recorders are designed to be reliable and simple to operate. Should you need assistance, DTS has support engineers worldwide with extensive product knowledge and test experience to help via telephone, e-mail or on-site visits.

The best way to contact a DTS support engineer is to e-mail support@dtsweb.com. Your e-mail is immediately forwarded to all DTS support engineers worldwide and is typically the fastest way to get a response, particularly if you need assistance outside of normal business hours. For assistance by telephone, please go to http://dtsweb.com/support/techsupport.php to find the phone number appropriate for your region of the world.

This manual supports the following products:

    13000-60160: TSR PRO 50 g Shock Recorder (primary)
    13000-60161: TSR PRO 50 g Shock Recorder (rechargeable)
    13000-60170: TSR PRO 250 g Shock Recorder (primary)
    13000-60171: TSR PRO 250 g Shock Recorder (rechargeable)
    13000-60190: TSR PRO-HB 500 g Shock Recorder (primary)
    13000-60191: TSR PRO-HB 500 g Shock Recorder (rechargeable)
    13000-60210: IDR (Incident Data Recorder); 250 g (primary)

Introducing the
TSR PRO and TSR PRO-HB Shock Recorders

The TSR PRO and TSR PRO-HB shock recorders are rugged data recorders with an integrated three-axis accelerometer and temperature sensor. The TSR is an ultra-low-power system that permits unattended monitoring of shock and vibration events. When armed, the TSR waits in a ready state to record any event where the specified acceleration threshold is exceeded. It then returns to the ready state to wait for the next event.

Overview of TSR Features

- Rated for 500 g dynamic testing environments.
- Internal, three-axis accelerometer with factory set ranges of ±50 or ±250 g (TSR PRO) and ±500 g (TSR PRO-HB).
- Internal 1 GB flash for >2 hours of data at maximum sampling rate.
- Records internal temperature, date and time for each event.
- 16-bit ADC.
- Both models are available with either an integrated, rechargeable battery (rechargeable) or user-replaceable, non-rechargeable battery (primary).
- Available 6-36 VDC external power input uses internal battery as back-up.
- Programmable level trigger from 2 to 10% of full scale.
- All communication signals and power/battery charging are supported via the DB15F interface.
- Integrated thru holes for mounting.

TSR PRO (primary)
(rechargeable also available)

TSR PRO-HB (rechargeable)
(primary also available)

Triaxial Accelerometer

The TSR PRO and TSR PRO-HB are supplied with an integrated, three-axis, MEMS accelerometer with DC response (300 Hz for TSR PRO; 1650 Hz for TSR PRO-HB). If you are unsure what range your TSR supports, this information is available from within the software via the Diagnostics window.

Temperature Sensor

The TSR PRO and TSR PRO-HB are supplied with an integrated temperature sensor. A single sample temperature measurement is recorded for each event. There are no user-selectable settings for the temperature sensor.

DB15F Interface/Communications

All communication signals and power/battery charging are supported via the DB15F interface. A TSR-to-USB communi-cation/power cable (DTS P/N 13000-60130) is provided with your unit. Information on installing the software, initializing the TSR, downloading and viewing data is given below. See Appendix A for connector information and pin assignments.

Power/Charging Requirements

The TSR contains either an integrated, rechargeable battery or a user-replaceable, non-rechargeable battery sufficient to operate the unit for extended periods.

	Rechargeable Battery	Non-Rechargeable (primary) Battery
Capacity/Type	900 mAh lithium	3.6 V, 2400 mAh lithium AA cell
Battery life[1]	3 months	6 months
Replace	N/A. Do not remove the battery; these units are not user-serviceable.	User replaceable with Tadiran TL-5903[2] or similar
Charge	Always charges when connected to USB (via AC or DC); ~4.5 hours from complete discharge to full charge.	N/A. These units are not rechargeable.
LED	☀ (1 Hz) = charging ● = full charge ☀ = battery low[3]	☀ = battery low

[1] Depends significantly on operating mode and use conditions.
[2] Data sheet can be found as Appendix C.
[3] Unit will shut down automatically to prevent overdischarge.

Using External Power

When external power is connected, the internal battery functions as a back-up power source. Should primary power be lost, the back-up battery will support data collection

until primary power is restored or until the internal battery discharges completely and the unit shuts down. See Appendix A for connector information and pin assignments.

Status (STS) LED
This LED is green, blue or red and is on, off or blinking.
- Green (blinking once per second): Battery is charging (rechargeable units only)
- Green (solid): Battery is fully charged (rechargeable units only)
- Green (short flashes): USB communication in progress
- Blue (solid): Impact event/data recording in progress
- Blue (blinking increasingly fast): Arming/sensor warm-up
- Blue (during arming): Preparing flash memory
- Red (blinking): Battery low
- Red (solid): Hardware error

> **WARNING:**
>
> **Do not perform any critical tests when the LED indicator is blinking red (battery low).**

Magnet and Motion Sensor Options
The TSR includes a magnet sensor and motion sensor to aid in power savings for certain applications.

The magnet sensor can detect the presence of a magnet in close proximity to the TSR. This sensor is used to allow the TSR to go into a deep sleep when the magnet is absent or fully prepare for data acquisition when the magnet is present. When the magnet is integrated into the TSR mounting scheme, the TSR will automatically prepare itself for data collection once installed.

The motion sensor detects very small levels of vibration and motion. When the TSR is motionless for an extended period, it can go into a deep sleep to preserve battery life. When motion is detected it will wake and prepare itself for data collection.

Should you wish to implement these capabilities, please contact DTS Technical Support for assistance.

Basic Care and Handling

The TSR is a precision device designed to operate reliably in dynamic testing environments. Though resistant to many environmental conditions, care should be taken not to subject the unit to harsh chemicals, submerge it in water, or drop it onto any hard surface.

> **WARNING:**
>
> **Electronic equipment dropped from desk height onto a solid floor may experience as much as 10,000 g. Under these conditions, damage to the exterior and/or interior of the unit is likely.**

The TSR is supplied with calibration data from the factory. DTS recommends annual recalibration to ensure that the TSR is performing within factory specifications. With the exception of the user-replaceable (primary) battery, the TSR is not user-serviceable and should be returned to the factory for service or repair.

When not in use or if shipping is required, we suggest that you always place the unit in the padded carrying case originally provided with your unit.

Shock Rating
The TSR is rated for 500 g (survivable to 2,000 g), 1 ms duration, in all axes and can be mounted directly on a vehicle, sled or other dynamic testing device.

Mounting Considerations
The unit should be securely bolted to the test article or dynamic testing device to provide the best shock protection. Mounting methods and hardware selection should be carefully calculated to withstand expected shock loading. (See Appendix B for the TSR's mechanical specifications.)

Thermal Considerations
The TSR is an extremely low power device with negligible self-heating and it is unlikely that self-heating will be an issue in real-world testing. Should you have any questions about using the TSR in your environment, please contact DTS.


TSR Control 2 Software

Software Installation
1. Locate the TSR Control 2 Setup.exe file on the CD or USB drive provided.
   Note: If you do not have the TSR Control 2 install file, please contact support@dtsweb.com.

2. Double-click the file to begin the installation and follow the prompts.
   Note: For Windows® XP systems, you may be asked to locate the .NET driver. When prompted, you will need to BROWSE to C:\DTS\TSR Control 2\Drivers.
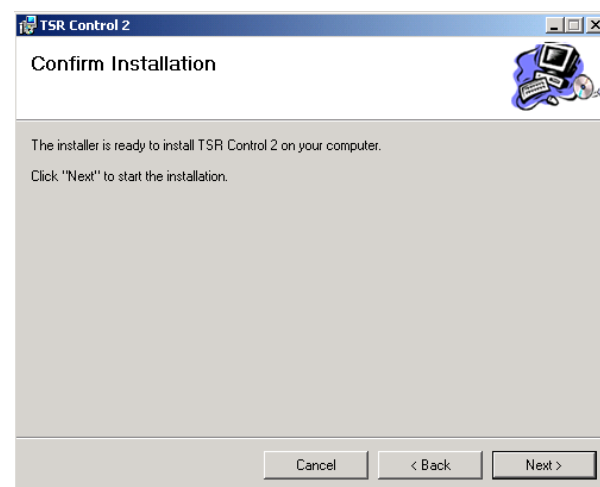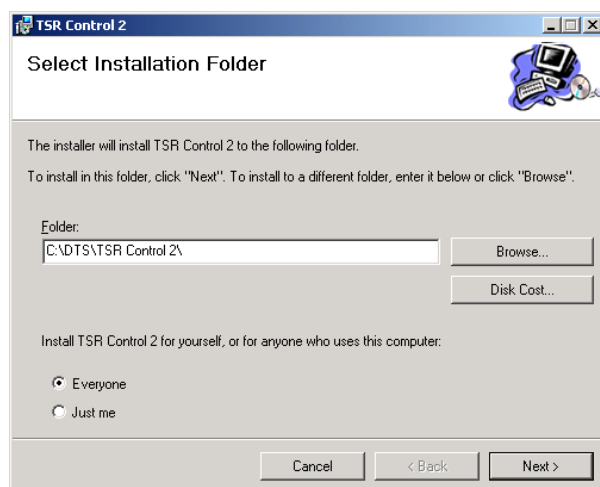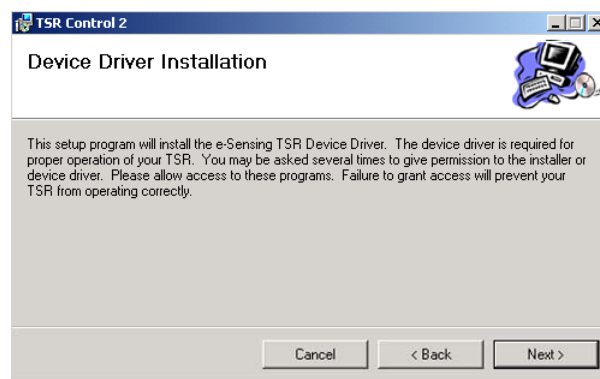
3. When you see this screen, installation is complete. Installation will add icons to your desktop, a quick launch toolbar, and TSR Control to your start menu programs.
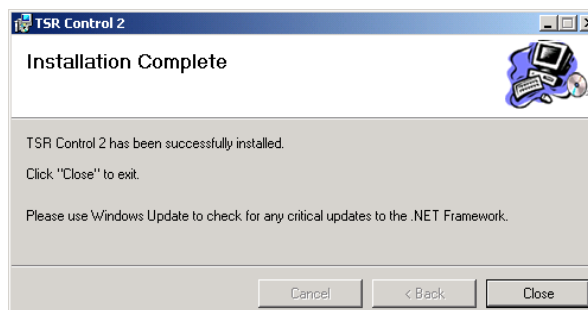
4. Start TSR Control by double-clicking the desktop icon or go to C:\DTS\TSR Control 2 and find the TSR Control 2.exe file.

Communicating with the TSR

5. Connect the PC to the TSR using the supplied cable. (The TSR can be connected to the PC before or after starting the software.)

6. Your screen will look one of two ways, depending on whether the TSR is connected when the software is started.

no TSR connected   **TSR connected**
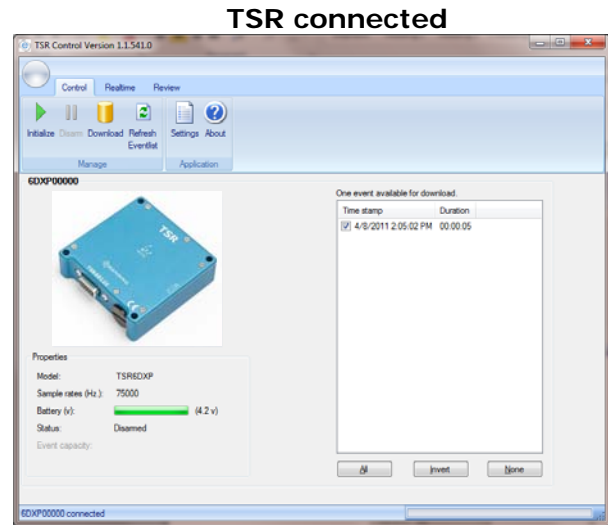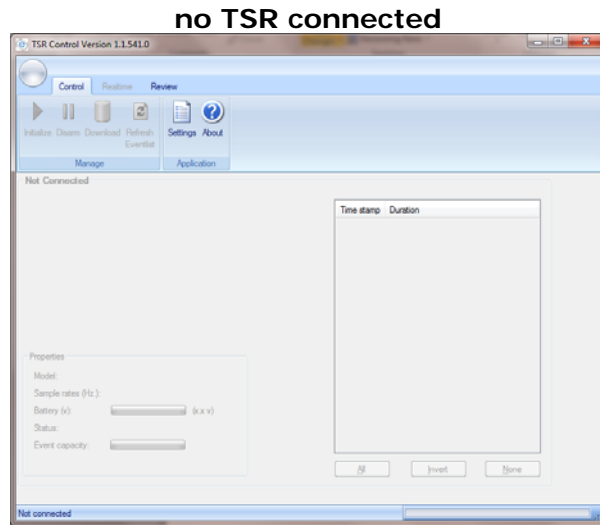

Initializing the TSR to Collect Data

1. Click Initialize button. Choose the recording time (seconds) and trigger threshold (g) for each channel. For this version of software, the sampling rate is fixed at 10 ksps/channel. (Initializing the TSR synchronizes its timestamp with the PC.)
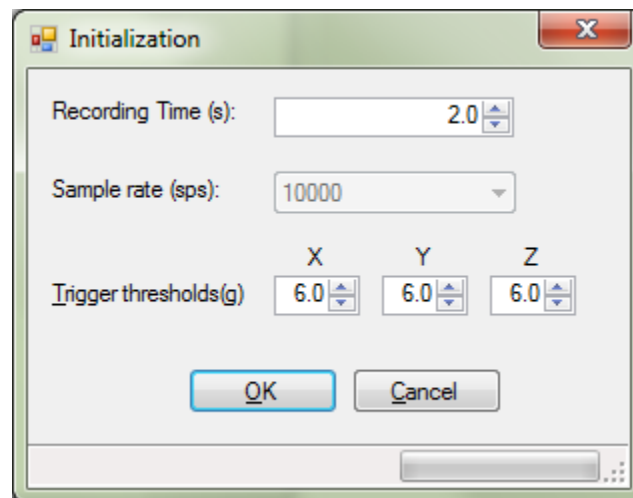
2. After clicking OK, a dialog box will indicate that the system is armed. You can then disconnect the TSR from the PC. The LED will flash blue for ~30 seconds while it is in its arming and sensor warm-up phase. When the LED goes dark, the unit is armed. The TSR will trigger and collect data for the programmed period if the g threshold on any axis is met. The system will automatically re-arm for another event after the previous event recording is complete.

Downloading Data

1. Reconnect the TSR to the PC using the supplied cable.

2. The software will ask if you want to disarm the TSR. Click Yes. The TSR must be disarmed before you can download the data.

3. Click the Download button. Depending on the length of the test, it may take several minutes or longer to download the data. A progress bar is shown in the bottom right corner of the screen.

4. You can download multiple events if more than one is stored in the TSR. You can select which events to download or download them all. (Data is available for repeated download until the unit is reinitialized.)
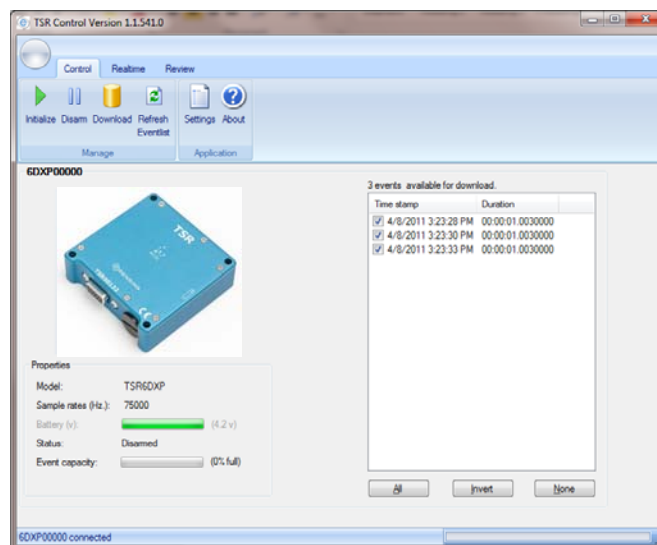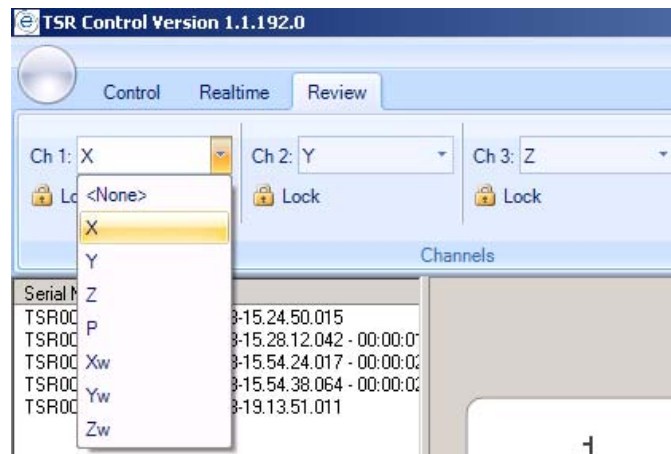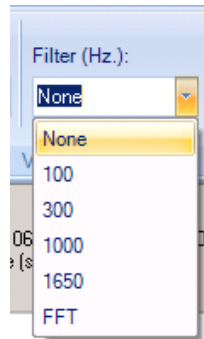
Viewing Data

1. From the screen, click the Review [Review] tab. Available data sets for viewing are shown on the left. These data sets are stored on your PC, not the TSR.
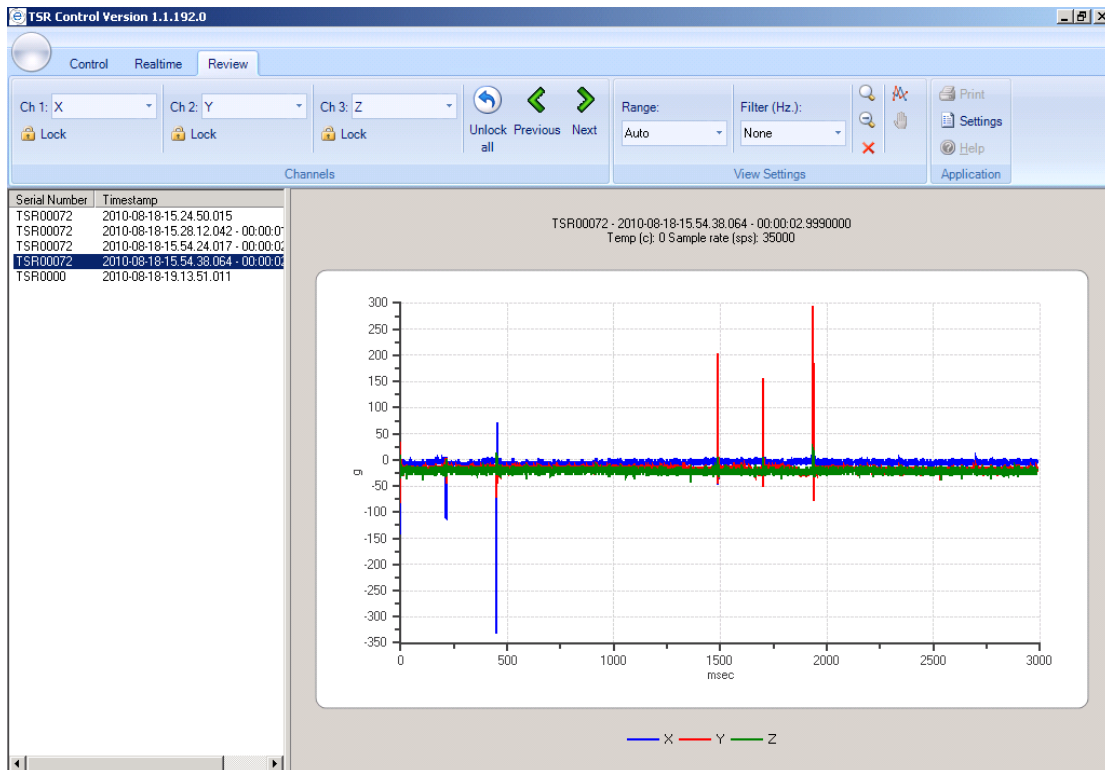
2. To Zoom, you must first select the zoom icon [🔍] on the upper right of the screen. You can then use the mouse to draw a window around the data you wish to zoom in on.

3. Three data channels can be viewed on the graph at one time. You can choose which channels to view with the upper left controls.

4. The data can be viewed unfiltered or with a -3 dB filter point from the pick list. An FFT on the data can also be performed.

Exporting Data

All data is stored in CSV file formats that can be read by Microsoft Excel® or other programs. Data is stored in the C:\DTS\TSR Control 2\Data directory under the serial number for TSR recorder.

Real Time Mode

To view data from the channels real time, click the Realtime tab. You can view any or all of the three channels. Note that the data is being sampled continuously at a relatively low sample rate. For example, you may not see a short duration data pulse when hitting the TSR against a surface.

Appendix A: Connector Information

15-pin interface connector (DB15F)
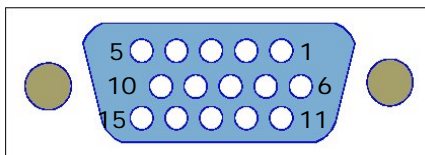
(panel view)

Pin	Function
1	USB_DP
2	+Status output contact closure, normally open (maximum external voltage 36 VDC, 30 mA)
3	+Event output (5 V, 30 mA maximum relative to pin 13)
4	+Event input (maximum external voltage 7 V)
5	Ground
6	Ground
7	+VDC input (6-36 V range)
8	USB_PWR
9	+External event[1]
10	Reserved
11	USB_DM
12	-Status output
13	-Event output
14	-Event input
15	Ground

[1] Most configurations do not support external event power. For more information, please contact DTS Technical Support.

Appendix B: Mechanical Specifications
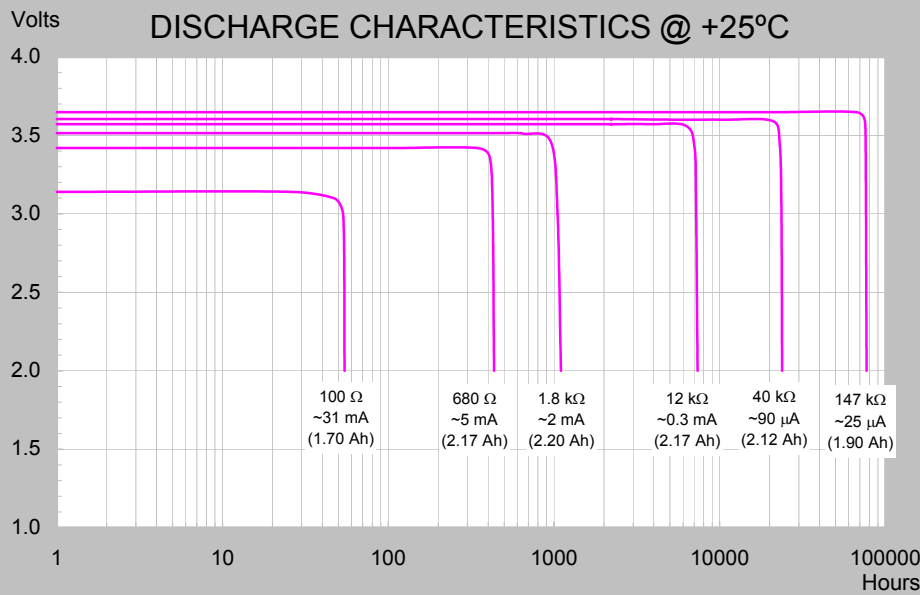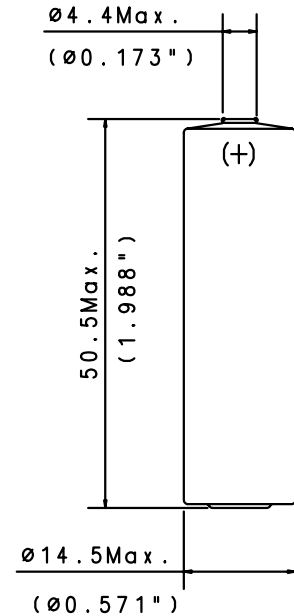
Weight: ~240 g (~8.5 oz)
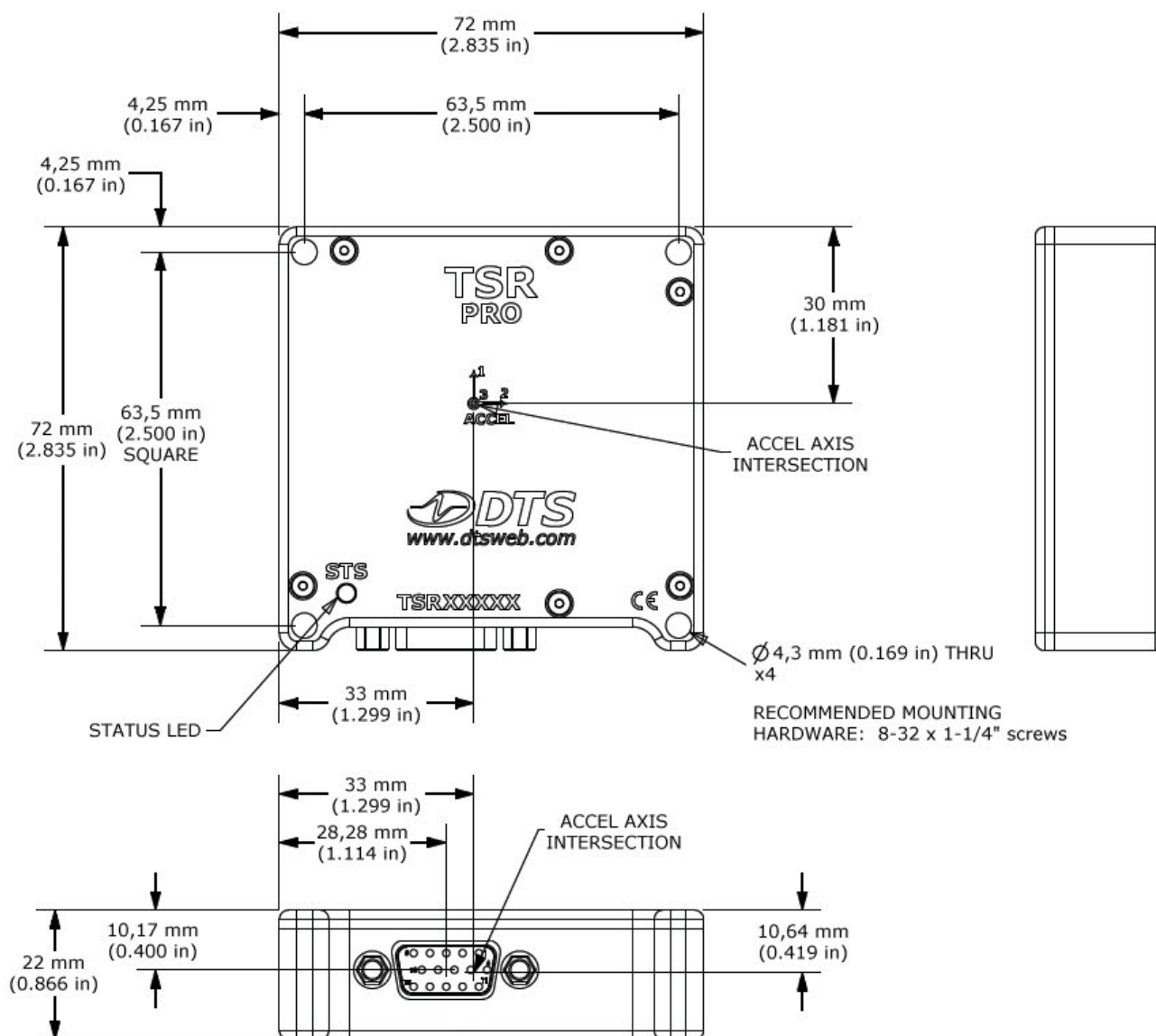
MODEL TL-5903

International size reference: AA, ER14505

TECHNICAL DATA

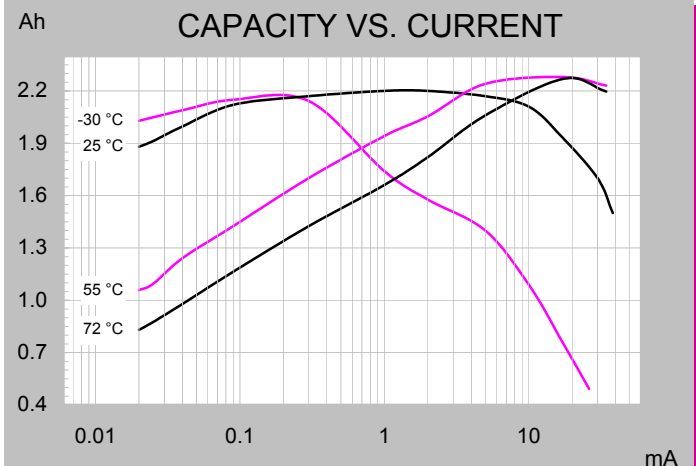(Typical values @+ 25ºC for batteries stored for one year or less)

- Nominal capacity — 2.4 Ah
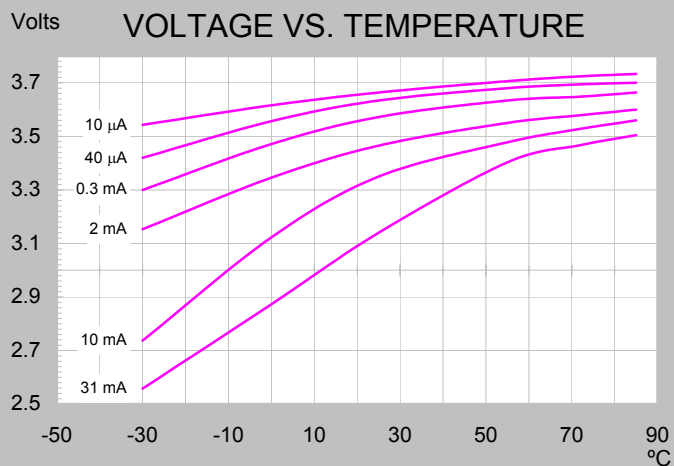- Rated voltage — 3.6 V
- Maximum recommended continuous current — 100 mA
- Maximum pulse current capability — 200 mA
- Weight — 18 g (0.635 oz)
- Volume — 8 cc
- Operating temperature range — -55 ºC to +85 ºC
- Li metal content — approx. 0.65 g
- U.L. Component Recognition, MH 12193

ø4.4Max.
(ø0.173")

(+)

50.5Max.
(1.988")

ø14.5Max.
(ø0.571")

DISCHARGE CHARACTERISTICS @ +25ºC

| 100 Ω ~31 mA (1.70 Ah) | 680 Ω ~5 mA (2.17 Ah) | 1.8 kΩ ~2 mA (2.20 Ah) | 12 kΩ ~0.3 mA (2.17 Ah) | 40 kΩ ~90 µA (2.12 Ah) | 147 kΩ ~25 µA (1.90 Ah) |

TERMINATIONS & ORDERING NO.

SUFFIX- /S STANDARD		15-5903-21500
SUFFIX- /T SOLDER TABS		15-5903-31500
SUFFIX- /P AXIAL PINS		15-5903-41500
SUFFIX- /PT2 RADIAL PINS		15-5903-36500
SUFFIX- /TP POLARIZED TABS		15-5903-52500
SUFFIX- /PT POLARIZED TABS		15-5903-53500

VOLTAGE VS. TEMPERATURE

10 µA
40 µA
0.3 mA
2 mA
10 mA
31 mA

CAPACITY VS. CURRENT

-30 °C
25 °C
55 °C
72 °C

iXtra - Long Term High Performance

Note: Any presentations in this data sheet concerning performance are for information purpose only and are not construed as warranties either expressed or implied, of future performance.

ECN 1501879 Rev. E 01/08

TL-5903

TADIRAN LITHIUM BATTERIES

CELL FEATURES

- 3.6 V Primary lithium-thionyl chloride (Li-SOCl2)
- Fast voltage recovery after long term storage and/or usage
- High energy density
- High and stable operating voltage
- Low self discharge rate
- Bobbin construction
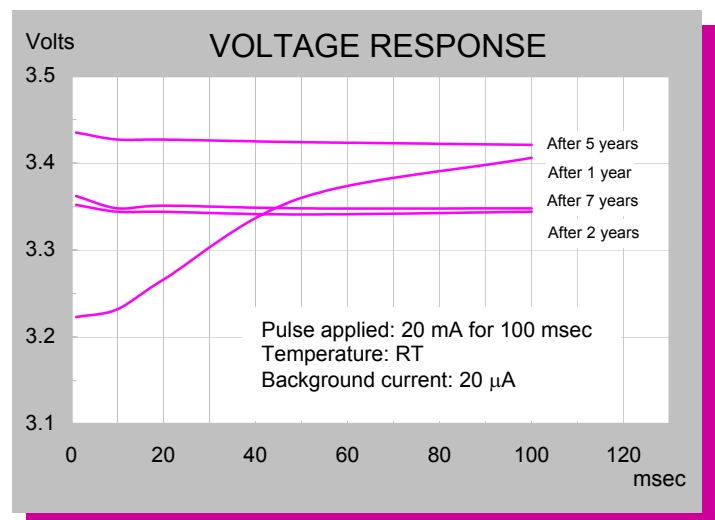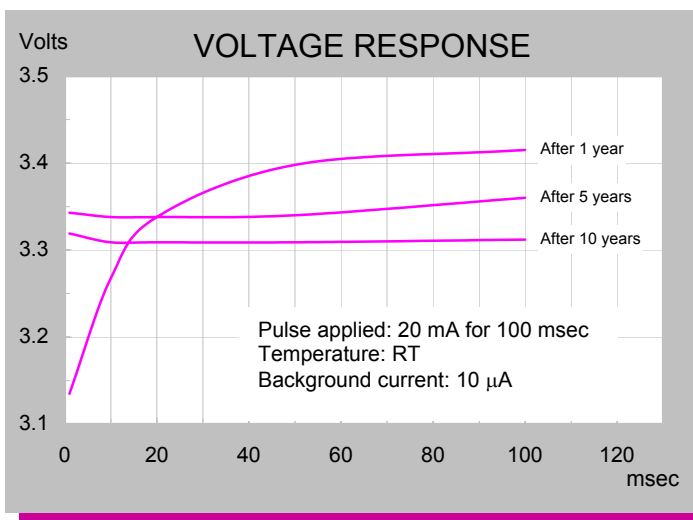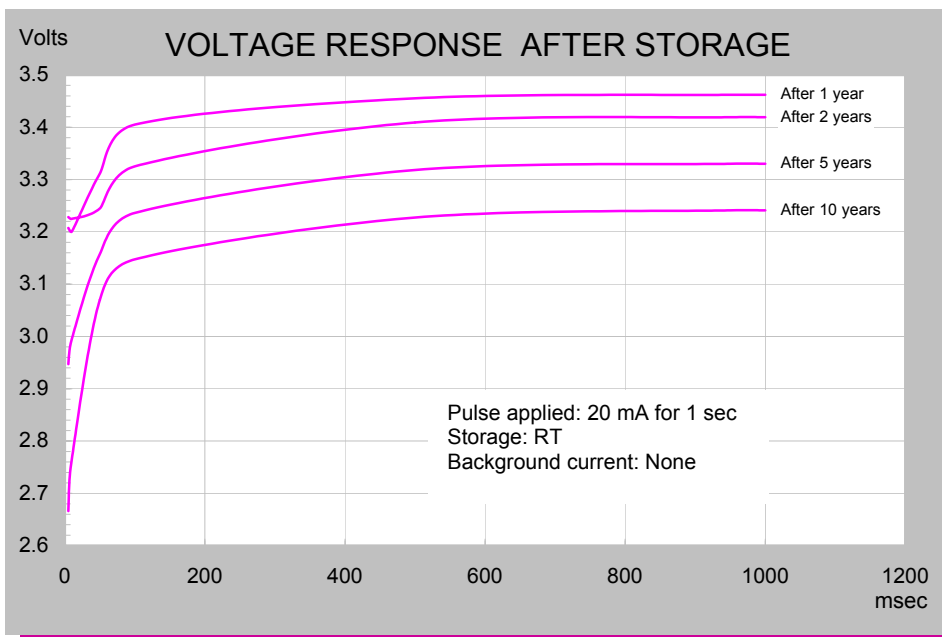- Hermetic glass-to-metal-sealing
- Non-flammable electrolyte

MAIN APPLICATIONS

- Utility meters (elect., water & gas)
- Automatic meter reading
- RF systems
- Sensors & monitoring systems
- Tracking systems
- Wireless security systems
- Automotive electronics
- Industrial electronics
- Ultra Low Power (ULP)

STORAGE CONDITIONS

- Cells should be stored in a clean & dry (less than 30 % RH) area

For updated information please visit our website **www.tadiranbat.com**

VOLTAGE RESPONSE AFTER STORAGE

Volts

After 1 year
After 2 years
After 5 years
After 10 years

Pulse applied: 20 mA for 1 sec
Storage: RT
Background current: None

VOLTAGE RESPONSE

Volts

After 1 year
After 5 years
After 10 years

Pulse applied: 20 mA for 100 msec
Temperature: RT
Background current: 10 μA

VOLTAGE RESPONSE

Volts

After 5 years
After 1 year
After 7 years
After 2 years

Pulse applied: 20 mA for 100 msec
Temperature: RT
Background current: 20 μA

iXtra - Long Term High Performance

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